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ABSTRACT

The American College Testing (ACT) Assessment Program is reviewed in this four-part report in terms of its use at North Harris County College (NHCC). Part I briefly reviews the contents of the four ACT tests: English Usage, Mathematics Usage, Social Studies Reading, and Natural Science Reading. It goes on to discuss the stability, limitations, and predictive validity of the tests and to make general comments on their nature and scoring. Section II describes ACT's Research Services, including the Class Profile Service, the Predictive Research Services for postsecondary institutions, the High School Profile Service for secondary schools, and the Institutional Self-Study Services, which provide follow-up data on postsecondary students. Section III reviews the current status of the ACT Assessment Program at NHCC, evaluating the usefulness of the data provided by the Class Profile Service and the Predictive Research Services. This section includes summary data. Section IV concludes that ACT's Class Profile Service provides an accurate sampling of the academic abilities of entering freshmen, but that the Predictive Research Services' NHCC studies have not proven effective in predicting student success at the college. Appendices include a detailed content description of the four ACT tests, the table of contents from a Basic Research Service Report, and the table of contents from a Standard Research Service Report. (KL/AIC)

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A COMMUNITY COLLEGE USER'S APPROACH TO AMERICAN COLLEGE TESTING DATA

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THE ACT ASSESSMENT PROGRAM AT NORTH HARRIS COUNTY COLLEGE

INTRODUCTION

The American College Testing Program was founded in 1959 with the original purpose of providing student assessment services to institutions of higher education for the counseling, placement, and admission of students to college. The original form of that assessment was the four tests of the ACT Assessment.

As the ACT program developed so did its purpose expand, the Predictive Research Services were added in 1961, the Student Profile Section in 1964, the Class Profile Section in 1965, and the High School Profile Service in 1969. The purpose of this paper is not to offer a comprehensive review of the entire ACT program, but to provide an evaluation of how effectively the ACT program can help NHCC reach its educational goals. The evaluation will seek to answer two questions: (1) Does ACT provide us with an accurate description of the entering freshmen at NHCC? (2) Does ACT operate as an effective predictor of student success at NHCC?

1. The Tests of the ACT Assessment

The four tests of the ACT Assessment, English Usage, Mathematics Usage, Social Studies Reading, and Natural Sciences Reading are an outgrowth of the Iowa Tests of Educational Development. The four academic tests of the ACT measure abilities in the subject areas traditionally identified with college and high school programs.

The English test claims to measure students' understanding and use of the basic elements of correct and effective writing; the mathematics test, their mathematical reasoning and problem-solving ability; the social studies test, the evaluative reasoning and problem-solving skills required in the social studies; and the natural science test, critical reasoning and problem-solving skills. The items on the tests claim to sample from each of the six categories of the cognitive domain as identified in Bloom's Taxonomy of Educational Objectives. More detailed descriptions of each of the four tests are located in the Appendix (A-1, pages 10-17).

Examination of the stability of the ACT tests, their content, and their relation to the constructs of aptitude and achievement all tend to support the interpretative use of the ACT tests as measures of developed academic ability. The content area of the tests has some limitations, however, and while many writers have criticized this weakness as reducing the effectiveness of the tests in making individual student decisions, the tests have been extensively validated by consistently predicting college grades. The review in Buros' Seventh Mental Measurements Yearbook (7:330) comments that the predictive validity of the tests is as satisfactory as the state of the measurement art currently permits.

Further review of the literature offers some interesting insight into the nature of the ACT tests. The history of testing is replete with attempts to distinguish between aptitude and achievement. Aptitude tests have tended to contain novel item formats for which a broad kind of reasoning is required while achievement tests posed questions in formats more similar to the way in which abilities were developed. Aptitude tests are most often intended for use in predicting future performance, and achievement tests, as traditionally defined, measure past performance and can be used to predict the future.

The ACT is not strictly representative of either achievement or aptitude items, the tests contain subject matter content like achievement tests, but require general reasoning and use of new information like aptitude items. For example, a student with little scientific background or interest but a high critical thinking ability may score high on the Natural Sciences Reading test. Differences in background influence test results making it impossible to separate the contribution of environment and heredity to an individual's test score.

The four ACT tests intercorrelate (on several large samples) in the .60-.70 range which indicates considerable relationship among the test scores. Analysis reveals that there is a common core of related abilities dominant in all four of the tests. This indication means that the use of the composite score is the most appropriate measure of developed general academic ability. High intercorrelations also exist between the ACT tests, the SAT tests and several other common measures of aptitude and achievement.

II. ACT Research Services

The ACT Research Services provide three primary services: the Class Profile Service, the Predictive Research Services for institutions of higher education, and the High School Profile Service for secondary schools. A fourth service, the Institutional Self-Study Service, also provides institutions of higher education with data about their students after students have spent some time at the institution.

The Class Profile Service provides a comprehensive description of the entering freshman class at a college along with a parallel description of those students who considered the college but did not enroll. Characteristics include students' academic abilities, goals, and aspirations; needs for student personnel services; students' out-of-class accomplishments; students' college choice considerations; and students' demographic characteristics. This service is of use in public information programs, student personnel functions, admissions, administration, and institutional programs.

The Predictive Research Services allow institutions to analyze the relationship of ACT scores and high school grades to first semester college grades. The Predictive Services include a Basic Research Service and a Standard Research Service, with the Standard Service providing data similar to but more extensive than the Basic Service in that separate analyses are available for up to nine groups of students. Copies of the contents of the Basic Research Service Report and the Standard Research Service Report are shown in the Appendix (A-2, page 18 and A-3, pages 19-20).

III. Current Status of the ACT Assessment Program at North Harris County College

The primary purposes of the ACT assessment program at NHCC are student counseling and placement. Uses of the program are described in the NHCC Handbook of Policies and Procedures, Section 413. ACT or transformed SAT test scores and past academic records serve as indications of likely future achievement. Students are required to take the ACT as part of admission procedures at NHCC unless they are exempt as defined in the NHCC Bulletin 1977-1978 on page 15.

Analysis of the registration records of 4,390 students enrolled in Spring, 1978 revealed the following.

- 1,382 student ACT scores are available or can be validated (Code 0)
- 1,578 students are exempted from providing ACT scores (Code 4)
- 1,430 students who are required to provide ACT scores have not done so (Code 8)

At the present time, admission into English 132 is determined by an English ACT score of 15 or higher. Students below that level are advised into Developmental Studies, English 130, or English 131. Admission into Math 132 is determined by a Math ACT score of 23-26 or completion of two years of high school algebra. Students below that level are advised into Math 130A, 130B, or 131.

The ACT Class Profile Service provided by ACT has provided what appears to be an accurate description of the students at NHCC. A review of ACT scores for 1,444 students enrolled at NHCC since 1973 shows that ACT class profiles have been comparatively consistent from year to year (See Table 1). A printout of 1,094 enrolled and interested but nonenrolled students from October 1976 to February 1978 confirms the profile shown in Table 1.

TABLE 1

ACT Class Profiles - NHCC Enrolled Freshmen

Year	N	ACT English	ACT Math	ACT Soc Stu	ACT Nat Sci	ACT Composite
1973-74	84	13.4	12.8	13.5	16.0	14.0
1974-75	95	15.5	12.8	15.6	17.0	15.4
1975-76	211	15.3	13.1	13.7	17.6	15.0
1976-77	376	14.7	13.4	13.9	17.5	15.0
1977-78	678	13.9	12.3	14.1	17.1	14.5
Total	1444	Wt Avg 14.39	12.85	14.06	17.21	14.73
<u>Comparison</u>						
Total	1094	14.21	12.16	14.20	17.01	14.50

A study of enrolled and nonenrolled freshmen at North Harris County College from 1973 to 1977 shows a student well below national norms, slightly below Texas state norms, but on a par with Texas junior college norms (See Table 2).

TABLE 2

ACT Freshmen Class Profiles Comparisons

	N	English	Math	Soc Stu	Nat Sci	Composite
1973-74						
Group #1	84	13.4	12.8	13.5	16.0	14.0
Group #3	43,871	16.8	16.9	16.6	18.6	17.3
Group #4						16.3

1974-75						
Group #1	95	15.5	12.8	15.6	17.0	15.4
Group #2	144	15.5	13.5	15.0	17.7	15.6
Group #3	34,633	16.7	16.5	16.4	18.9	17.2
Group #4	16,058	15.3	14.8	14.8	17.6	15.7
Group #5	45,272	18.2	18.9	18.7	21.1	19.4
Group #6	52,160	17.2	17.1	16.7	19.4	17.7
Group #7	73,995	17.9	18.3	18.1	20.8	18.9

1975-76						
Group #1	211	15.3	13.1	13.7	17.6	15.0
Group #2	252	15.5	13.0	13.7	18.3	15.3
Group #3	36,629	16.4	15.6	15.5	19.1	16.7
Group #4	18,157	14.8	13.7	13.6	17.5	15.1
Group #5	45,222	17.6	17.9	17.7	21.0	18.7
Group #6	50,393	16.8	15.9	15.4	19.2	17.0
Group #7	69,166	17.5	17.5	17.0	20.8	18.3

1976-77						
Group #1	376	14.7	13.4	13.9	17.5	15.0
Group #2	369	14.9	12.5	13.9	17.1	14.7
Group #3	38,293	16.1	15.0	14.9	18.6	16.3
Group #4	16,787	14.3	13.0	12.8	16.7	14.4
Group #5	48,808	17.6	17.8	17.4	20.9	18.5

1977-78						
Group #1	678	13.9	12.3	14.1	17.1	14.5
Group #2	742	14.2	11.5	13.7	16.6	14.1
Group #5	47,614	17.7	17.6	17.4	21.1	18.6

Group #1 - NHCC Enrolled Freshmen
 Group #2 - NHCC Nonenrolled Freshmen
 Group #3 - Texas State Composite Freshmen
 Group #4 - Texas Junior College Norms
 Group #5 - National Freshmen Norms (10%)
 Group #6 - Texas High School Norms
 Group #7 - National High School Norms

The ACT Predictive Research Services have not been as useful at NHCC as has the Class Profile Services. The limited size of the groups provided for predictive study, the diverse academic abilities of our students, the commuter campus, the changing socio-economic status of the area residents have all combined to reduce the effectiveness of the ACT research provided.

For example, in the Basic Research Service Report for NHCC 1975-76 freshmen, Table 6, Academic Abilities and Grading Practices, we see that by ACT composite, NHCC students are in the 4th percentile by score, in the 37th percentile by high school average, and in the 94th percentile by college grade point average (as compared to national norms). In the 1976-77 Standard Research Report, Table H-1, Relative Efficiency of Different ACT Indices in Predicting College Grades, we find that overall efficiency in predicting college grades using ACT scores is at .509, and when high school averages are added, goes up to a very satisfactory .586.

The optimism of the ACT figures has not been borne out by the four small and admittedly limited studies of ACT predictive effectiveness made here at the college. The first study concerns 62 students enrolled in two sections of Math 132 (College Algebra), 132.01 and 132.02, from Fall, 1977. Of these 62 students, 21 completed satisfactorily (34%), 41 withdrew or received an NC. Of the 62 students, 38 had ACT scores, the average grade was .81 with D equated to 1.00, the average ACT math score was 18.2. Using Pearson's correlation coefficient formula, the relationship between ACT scores and final grade (including W or NC) was estimated at .4334, showing that ACT has some moderate value in predicting outcome. When r was raised to r^2 , a 19% relationship was shown to exist between the two variables.

The second study dealt with all the 239 students enrolled in Accounting I, Fall 1977. Of these 239 students, 135 completed satisfactorily (56%), 104 withdrew or received an NC (44%). Of the 239, 55 had ACT scores, the average grade was 1.27 with D equated to 1.00, the average ACT composite score was 15.51. Using Pearson's correlation coefficient formula, the relationship between ACT scores and final grades (including W or NC) was estimated at .3951 showing a low to moderate relationship using ACT as a predictor of outcomes. When r was raised to r^2 , a 16% relationship was shown to exist between the two variables.

The third study dealt with all of the 102 students enrolled in Office Accounting, Fall 1977. Of these 102 students, 74 completed satisfactorily (73%), 28 withdrew or received an NC (27%). Of the 102, 28 had ACT scores, the average grade was 2.82 with D equated at 1.00, the average ACT composite score was 13. Using Pearson's correlation coefficient formula, the relationship between ACT scores and final grade (including W or NC) was estimated at .3330 showing a low relationship between ACT and grade. When raised to r^2 , an 11% relationship was shown to exist between the two variables.

The fourth study dealt with 543 students who had enrolled in English Developmental Studies Courses, English 130 and 131 from Summer, 1975, to and including Spring, 1978. Of these 543 students, 217 (40%) have attempted English 132, and, as the following shows, have met with some measure of success. Of the 217 attempting English 132, 77 are still in progress (Spring, 1978), 75 completed successfully, 3 have incompletes, and 62 withdrew (NC). Of those students attempting English 132, 82 had ACT English scores and a grade (including W or NC) in English 132. The average grade in English 132 was 1.30 with D equated at 1.00, and the average ACT English score was 11.21. Using Pearson's correlation coefficient, the relationship between ACT English score and final grade was estimated at .0661 showing very little to no relationship of ACT to grade outcome. When raised to r^2 , a relationship of .4 of 1% was all that existed between the two variables.

From these four studies (see Table 3), it appears that the effectiveness of the ACT score in predicting grades increases at NHCC as the ACT score increases. Whether this conclusion can be generalized to other courses at NHCC is not known; however, the review of the ACT literature does indicate higher predictive effectiveness near and above norm scores. For advising or counseling students, predictive correlations below .45 are of little value.

TABLE 3

Correlation of ACT Scores with College Grades

	Average Grade*	ACT Score	r
English 132	1.30	(Eng) 11.21	.0661
Office Accounting	2.82	(Comp) 13.00	.3330
Accounting I	1.27	(Comp) 15.51	.3951
Math 132	.81	(Math) 18.21	.4334

*D equates as 1.00

There are other indications that ACT data may not constitute a representative sampling of NHCC students. Predicted Grade Point Average for English 132 students was a mean of 2.73 and for History 131/Govt 231 students a mean of 1.96 according to the ACT Summary Analysis on the Standard Research Service Report for 1976-77 Freshmen (Table A-2).

Assuming that 1977-78 students were similar in achievement to 1976-77 students, a review of the average grades for all 657 NHCC students (many without ACT scores) enrolled in English 132 in Fall, 1977, showed an average grade of 2.08. A review of the combined average grades for all 1,071 NHCC students enrolled (many without ACT scores) in History 131 and Govt 231 in Fall, 1977, showed an average grade of 1.75.

IV. Evaluation of the ACT Assessment Program at NHCC

The evaluation of the ACT Assessment Program at NHCC revolves around the two questions asked in the introduction:

1. Does ACT provide an accurate description of the entering freshmen at NHCC? /
 2. Does ACT operate as an effective predictor of student success at NHCC?
1. Does ACT provide an accurate description of the entering freshmen at NHCC? The Class Profile Service provides what appears to be an accurate sampling of the developed academic abilities of entering freshmen (as measured by ACT score). The demographic information, along with the goals and special needs data, should become valuable as the size of the sample increases.

Division Use of the ACT scores:

English 132 - Students entering ENG 132 should score at least 15 on the ACT English subtest. Students scoring 10-14 have been advised into ENG 131, and 9 or below into ENG 130. A recommendation is made here that all students below 15 (on a composite ACT score that excludes Math) be advised into English Developmental Studies, where diagnosis for remediation will be made by the Developmental Studies team. The Missouri Test is currently being used for ENG 132 exit; the English Division is currently reviewing its use.

Math 132 - Students entering MATH 132 should score 23-26 on the ACT Math test or have completed two years of high school algebra. The high attrition rate in MATH 132 indicates that the current admission or guidance procedures need review. Possibly high school transcripts should be considered. Students scoring 16-22 are advised into MATH 131, and 15 or below into MATH 130A or B. A recommendation is made here that all students scoring below 23 on the ACT Math score be advised into Math Developmental Studies, where diagnosis for remediation will be made by the Developmental Studies team. A recommendation is also made here that a recognized exit test be used for MATH 132.

Social and Behavioral Sciences - No formal screening procedures for HIST 131, 132, GOVT 231, 232, or ECO 231 exist at present although HIST 130 has been used to prepare students for success in the Social Sciences. A great deal of concern for maximal student success has been evidenced by this department. Two options exist:

- a. Screen for admission into the five courses listed above on a level comparable with English ACT of 15 or above. Select recognized exit tests for each of the courses.
- b. Do not screen for admission formally. Strengthen guidance and registration procedures to identify students who need developmental courses. Recognize that unscreened courses will have a higher level of failure and attrition and lower grade point averages than screened courses. This option is recommended:

Developmental Studies - Students entering Developmental Studies will be individually diagnosed and prescribed by the Developmental Studies team. Exit from Developmental Studies will occur when the team judges a student is ready. To provide for recognized measures of progress along with transfers of learning, a recommendation is made that all developmental students take the ACT test before or immediately after entrance into the program. The exit tests used in ENG 132 and MATH 132 should provide measures of improvement in these students aspiring to higher level academic work.

Counseling and Advisement - The Counseling and Advisement Department is in the process of strengthening procedures so that students are counseled into programs that will be most beneficial to them. Improved placement procedures should reduce the number of students in courses for which they are unprepared. A recommendation is made that the Fall 1978 Staff Development Workshop be devoted to counseling and advisement procedures along with information on the ACT Assessment Program so that the entire faculty can join in appropriate directions along with the Counseling and Advisement Department.

Note - The identification of exit tests by some departments does not indicate that restrictions on teaching methodology, creativity, or academic standards will be imposed. Recognition that learning is often latent, and that affective behaviors are almost impossible to measure, must accompany the efforts at North Harris County College to be accountable.

2. Does ACT operate as an effective predictor of student success at NHCC?

Based on the four small studies done locally to check the effectiveness of the Predictive Services along with a comparison of ACT predicted grades with NHCC actual grades, the ACT does not appear to be successful in this area as yet. The limited size of the groups provided for predictive service, the diverse academic abilities of our students, the commuter campus, the changing socio-economic status of the community may be inhibitors of ACT predictive effectiveness. The possibility also exists that prediction based on a testing package designed to measure the experiences of traditional exposures of traditional students may not be appropriate for the community college student. As the number of NHCC students taking the ACT increases and the school acquires more historical data, more information about ACT predictive effectiveness should emerge.

APPENDIX A-1

In terms of Bloom's Taxonomy of Educational Objectives, the items on the tests of the ACT Assessment sample from each of the six categories of the cognitive domain:

1. knowledge
2. comprehension
3. application
4. analysis
5. synthesis
6. evaluation

The item types of each of the four tests differ in their amenability to testing certain categories. For example, the passage format of the Social Studies Reading and the Natural Sciences Reading lends itself to testing the higher level categories of analysis, synthesis, and evaluation. Items from the English Usage Test probably achieve no higher a level than the analysis category while Mathematics Usage falls primarily in the application category.

Content validity is of particular significance, a user should examine the content and intellectual skills required to respond correctly to the items. Whether the skills and understanding required in the test are similar to those required of the student in reading and study situations at the college can then be determined.

The ACT English Usage Test. The ACT English Usage Test is a 75-item, 40-minute test which measures the student's understanding and use of the basic elements in correct and effective writing: usage, phraseology, style, and organization. The test gives considerably greater weight to clear and effective expression and analysis of forms of expression than to rote recall of rules of grammar. In fact, grammatical rules in a state of transition are carefully avoided.

Four elements of effective writing are included in the English Usage Test. Definitions of the content areas and the approximate proportion of the test devoted to each are given in the table below.

The format of the test is several prose passages with certain portions underlined and numbered; for each underlined portion four alternatives are given. The student must decide which alternative is most correct or appropriate. In many respects the test represents a work sample of an English theme.

Content of the ACT English Usage Test

Grammar and punctuation. This includes punctuation and graphic conventions, usage in agreement, verb forms, adjectives and adverbs, pronouns and their antecedents, and nouns.

APPENDIX A-1 (Continued)

Sentence structure. This includes relation between clauses, parallelism, placement of modifiers, and predication and shifted constructions.

Diction. Under this rubric are items concerned with word choice and idioms, figurative language, and economical writing.

Logic and organization. Included here are logical organization of ideas, the elimination of inappropriate ideas and statements, proper wording of transitions, paragraphing, and appropriate conclusions.

<u>English Usage Content Area</u>	<u>Proportion of Test</u>	<u>No. of Items</u>
Grammar and Punctuation	.35	26
Sentence Structure	.25	19
Diction	.35	26
Logic and Organization	.05	4
Total	1.00	75

Implications of ACT scores as measures of academic English usage ability. The ACT English Usage Test does appear to measure aspects of academic English usage. However, there is no information available about generalizations to oral English usage. In addition, as will be seen in future sections, it is not appropriate to generalize the use of the scores to indicate actual participation in writing activities, such as those measured by the ACT out-of-class accomplishment scales.

The English Usage Test content covers usage but not other aspects of the typical English curriculum such as literature. Consequently, the content of the test does not justify its use as an indicator of general English ability.

Finally, an examination of the content has implications for generalizations to students of non-English or nonstandard English cultural backgrounds. The concern with English usage on the test may be expected to put such students at a serious disadvantage. Such a disadvantage may be appropriate where knowledge about the student's present ability to use standard (even academic) English is required. However, there are undoubtedly cases in which such knowledge is not essential to the successful attainment of some criterion. Therefore, a user should take great care in generalizing about the importance of English usage ability or an ACT English Usage Test score to a situation without a careful analysis of the situation.

The ACT Mathematics Usage Test. The Mathematics Usage Test is a 40-item, 50-minute examination which measures the student's mathematical reasoning ability. The solution of practical quantitative problems encountered in many college curricula is emphasized. A sampling of mathematical

APPENDIX A-1 (Continued)

techniques covered in high school courses is also included. The test emphasized reasoning in a quantitative context, rather than memorization of formulas, knowledge of techniques, or computational skills.

In general, the mathematical skills required do not exceed those included in high school plane geometry and first- and second-year algebra. The format of the mathematics item is a question with five alternative answers as illustrated by the examples of items from the Mathematics Usage Test.

Content of the ACT Mathematics Usage Test

Arithmetic and algebraic reasoning. These problems are word problems about practical situations in which algebraic and/or arithmetical reasoning is required. The problems require the student to interpret the question and find an approach to its solution. Some of the problems may require only advanced arithmetic for solution while others call for algebraic approaches.

Arithmetic and algebraic operations. In these problems, operations to be performed are explicitly described in the problem and the student must complete the designated operation. These problems include manipulation of fractions and decimals, operations with signed numbers, addition, subtraction, multiplication, and division of polynomials, solution of linear equations in one unknown, and manipulation of algebraic fractions.

Advanced algebra. These problems include dependence and variation of quantities related by given formulas, arithmetic and geometric series, solution of simultaneous equations, graphs of equations, inequalities, logarithmic principles, exponents, radicals, roots of equations, factoring and dividing polynomials, solution of quadratic equations.

Geometry. Topics include mensuration of lines and plane surface, properties of polygons, angular relationships involving parallel lines and polygons, relationships involving circles and properties of circles, loci, solid geometry, trigonometric principles, and the Pythagorean theorem. Both formal and applied problems are included under this category with most being formal.

Miscellaneous. This category includes problems in set theory, probability, logic, properties of numbers (prime, rational), and bases of number systems.

<u>Mathematics Content Area</u>	<u>Proportion of Test</u>	<u>No. of Items</u>
Arithmetic and Algebraic Reasoning	.35	14
Arithmetic and Algebraic Operations	.15	6
Advanced Algebra	.20	8
Geometry	.20	8
Miscellaneous	.10	4
Total	1.00	40

APPENDIX A-1 (Continued)

Implications of ACT scores as measures of academic mathematics usage ability. There are several implications of the content of the Mathematics Usage Test as explored in this section. First, it is based on high school mathematics through plane geometry and algebra and represents developed mathematics ability through that level. One may appropriately conclude that two students with the same test scores, one having taken high school math through geometry and the other having taken no math past the ninth grade, know and can use comparable amounts of the mathematics content of the test. However, the two scores may have different implications for what can be learned in some future situation. Present information about the meaning of scores is based primarily on students with some standard high school mathematics. Therefore, care should be taken in interpretations about Mathematics Usage scores for students with widely different mathematics backgrounds.

Other implications of the content concern its emphasis on reasoning and application and the reading ability required. If a user wishes to assess the degree to which the student has finger-tip command of formulas and definitions, the test will not be appropriate. And, as noted, because of the basic reading ability required, the test should not be interpreted as a pure nonverbal quantitative ability measure.

The ACT Social Studies Reading Test. The ACT Social Studies Reading Test is a 52-item, 35-minute test that measures the evaluative reasoning and problem-solving skills required in the social studies. There are two general types of items: the first is based on reading passages, the second on general background or information obtained in high school social studies courses. All items are multiple choice with four alternatives. The items based on the reading passages require more than reading comprehension skills. They require the student to draw inferences and conclusions; to extend the thoughts of the passage to new situations; to make deductions from experimental or graphic data; and to recognize a writer's bias, style, and mode of reasoning.

The test is generally based on social studies content in high school. Most of the items require inferences and general information rather than knowledge of specific facts. Those items based on reading passages are labeled inference items while independent items are labeled information items.

Content of the ACT Social Studies Reading Test

Social Studies Area	Inference Items		Information Items		Total	
	(Proportion of Test)	No. of Items)	(Proportion of Test)	(No. of Items)	Proportion of Test	(No. of Items)
European & Ancient History	.14	7	.06	3	.20	10
Government & American History	.28	15	.12	6	.40	21
Current Social Issues, Soc., Eco., etc.	.28	15	.12	7	.40	21
Total	.70	37	.30	15	1.00	52

APPENDIX A-1 (Continued)

Social studies reading ability. The two most commonly discussed and most generally identified ability factors correspond to some extent to the first two ACT tests. They are verbal and quantitative factors. No one has claimed to have identified an important independent dimension named social studies reading ability. However, social studies and natural sciences are two coherent groupings of subjects which students study in both high school and college. Not only is a Social Studies Reading Test important, therefore, to relate various ability factors directly to the subject area but also it is important to assess some specific abilities which play a special role in the area of social studies.

There are two primary aspects of the Social Studies Reading Test content which must be explored. First is the emphasis on reading the test. Approximately 70% of the test is devoted to questions requiring comprehension of and inferences from reading passages. There are several reasons for this emphasis. First, a survey by Kimball (1969) indicated that the types and timing of social studies courses vary considerably from student to student. Because of the variability in students' social studies programs in courses such as American history, world history, ancient history, civics, American government, world geography, economics, and problems of democracy, the test could not be tied to a presumed uniform high school curriculum. A second reason concerns the college courses in social studies and social science areas. Even a brief analysis of such courses indicates (a) that a large amount of reading is required and (b) that the student is required to read critically and to evaluate and make inferences from that reading.

The reading passages in the test are typical of selections encountered in high school and college social studies courses in three general categories: (a) European and ancient history, (b) government and American history, and (c) current social issues, sociology, economics. Thus while 70% of the test directly involves inferences from reading, the reading matter and the subject of the inferences relate directly to the social studies field.

The second content area includes the information items. The items sample from the many areas of social studies content, including, for example, all eight courses mentioned above. Again, as with other parts of the test, these items do not demand only simple factual recall but reasoning and application of social studies-related information.

On the basis of this discussion, the content of the test seems appropriate to a social studies reading measure. While the general reading ability assessed would seem applicable to most or all the areas usually included under the term academic social studies, the test does not systematically sample the student's knowledge of facts about social studies areas and consequently to refer to it simply as a social studies test might be misleading.

Implications of ACT scores as measures of academic social studies ability. As with each of the other tests, the discussions of content have implications for generalizations to uses which appear appropriate and uses which appear inappropriate on the basis of the content. The emphasis on reading

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has implications for many uses. If reading is important to the use, then the test may be appropriate. If not, then the test will not be appropriate.

Another implication concerns the content of the reading passages and of the information items. If, for example, one includes courses from a new black studies program in a college's social science division as might reasonably be done, then a user should recognize that the test does not now directly sample from that content area. However, if the same kind of reading ability is required in such a program as in the other traditional social science areas, then the scores would be pertinent.

The ACT Natural Sciences Reading Test. The Natural Sciences Reading Test is a 52-item, 35-minute test that measures the critical reasoning and problem-solving skills required in the natural sciences. There are two general types of items: the first is based on reading passages, the second on information about science. All items are multiple choice with four alternatives. The passages concern a variety of scientific topics and problems, with summaries of procedures and outcomes of experiments being perhaps the most common. The items require a student to interpret and to evaluate scientific materials, and in particular to understand the purposes of experiments, the logical relations between experimental hypotheses, and generalizations which can be drawn from the experiments. The information items ask the student to apply what he has learned in high school science courses to familiar, new, and analogous problem contexts. Arithmetic computation and algebra are avoided.

The test emphasizes the content covered in high school science curricula (Biology, Chemistry, Physics, etc.), scientific experimentation, and the "logic of science." In general the items involve inferences or deductions from passages, graphs, or experimental data; the application of principles; and the evaluation of experimental design and procedures.

Content of the ACT Natural Sciences Reading Test

Science Area	Inference Items		Information Items		Total	
	(Proportion of Test)	(No. of Items)	(Proportion of Test)	(No. of Items)	(Proportion of Test)	(No. of Items)
Biology	.36	19	.12	6	.48	25
Chemistry	.17	9	.06	3	.23	12
Physics, Geology, Astronomy, and General Science	.17	9	.12	6	.29	15
Total	.70	37	.30	15	1.00	52

Natural sciences reading ability. As with social studies, 70% of the ACT Natural Sciences Reading Test involves reading passages. However, the content, the emphasis, and the type of inferences which the student is asked to

APPENDIX A-1 (Continued)

draw differ in many important ways. In the Natural Sciences Reading Test the content is scientific, often a description of an experiment; and the emphasis is on the understanding and the interpretation of the experiment and on appropriate inferences which may be drawn from it.

Most college-bound high school students build upon an early general science course, with a course in biology, first, then perhaps chemistry, and finally physics. However, the sequence of all three courses does not appear to be a common phenomenon, except perhaps among aspiring science majors. Therefore, a test tied strictly to content in these three areas would not be equally applicable to most students.

The reading passages come primarily from biology, the high school science course most commonly taken by college-bound students, with chemistry passages and other science passages in areas such as physics or geology or general science completing the reading part of the test. Although the content areas of the passages conform to the commonly taught high school science areas, the passages are not directly tied to a typical curriculum; nor is specific content information a definite advantage in answering the questions. The remaining 30% of the test does sample the student's understanding and ability to apply general information in biology (48%), chemistry (23%), and other science areas (29%).

Although an examination of the critical scientific thinking and reading required in most college science courses supports the importance of academic natural science reading ability, one must again consider to what extent such an ability represents a more general natural science ability. There are at least three ways in which the content of the test does not adequately cover general natural sciences ability. First, as already noted, specific information in the sciences receives only a small emphasis and then primarily on biology and chemistry. Second, although experiments are described in the passages, the ability to perform an experiment in a laboratory, rather than just read about it, is an important aspect of science not covered in the test. Third, the creative aspects of the scientific endeavor, what might be called scientific ingenuity, are not directly tapped by the test.

Implications of ACT scores as measures of academic natural sciences ability.

The primary implications of the Natural Sciences Reading Test content involve the reading component of the test, its lack of information about laboratory ability or creativity, and its emphasis on critical scientific thinking rather than on specific scientific knowledge. The reading component has implications for the type of student tested just as it does on each of the tests. A nobel prize winning scientist with minimal knowledge of the English language would likely do poorly on the test. So the test as a measure of natural science reading ability generalizes only to populations with typical English language backgrounds. Second, to the extent that manipulative and other abilities used in a scientific laboratory are an important and distinct part of science ability, the content of the test is deficient as a measure of scientific ability. Similarly, scientific

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ingenuity is not directly included in the content of the tests. Whether the measure obtained relates to such abilities is not now known. Third, the emphasis on critical scientific thinking rather than on specific information has implications for uses in which specific scientific information is required since students with little scientific background or interest but high critical scientific thinking ability may score high on the test.

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BASIC RESEARCH SERVICE REPORT

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APPENDIX A-3

The American College Testing Program Research Services

STANDARD RESEARCH SERVICE REPORT

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This report is for your students who were freshmen during the academic year. Assistance in understanding this report and applying the results on your campus is provided in the publication Your College Freshmen: Interpretive Guide to ACT Research Services for Higher Education.

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